BEST AVAILABLE IMAGES

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images may include (but are not limited to):

- BLACK BORDERS
- TEXT CUT OFF AT TOP, BOTTOM OR SIDES
- FADED TEXT
- ILLEGIBLE TEXT
- SKEWED/SLANTED IMAGES
- COLORED PHOTOS
- BLACK OR VERY BLACK AND WHITE DARK PHOTOS
- GRAY SCALE DOCUMENTS

IMAGES ARE BEST AVAILABLE COPY.

As rescanning documents *will not* correct images, please do not report the images to the Image Problem Mailbox.

PCT/NZ00/00110

NZ00/00110

Intellectual Property Office of New Zealand

4

CERTIFICATE

This certificate is issued in support of an application for Patent registration in a country outside New Zealand pursuant to the Patents Act 1953 and the Regulations thereunder.

I hereby certify that annexed is a true copy of the Provisional Specification as filed on 24 June 1999 with an application for Letters Patent number 336471 made by MICHAEL CLARENCE CLAERHOUT;JEFFREY JOHN SHARP.

PRIORITY DOCUMENT
SUBMITTED OR TRANSMITTED IN COMPLIANCE WITH RULE 17.1(a) OR (b)

Dated 3 July 2000.

Neville Harris
Commissioner of Patents

COMMISSIONER OF PATENTS, TRADE MARKS & DESIGNS • NEW ZEALAND •

336471

PATENTS FORM NO. 4

Appln Fee: $80.00

James & Wells Ref: 15949/19 CA

PATENTS ACT 1953

PROVISIONAL SPECIFICATION

IMPROVEMENTS TO TRAILER BRAKING SYSTEMS

WE, Jeffrey John Sharp, a New Zealand citizen of 5 Moreka Court, Hamilton, New Zealand, and Michael Clarence Claerhout, a Canadian citizen, of 59 Higgins Road, Hamilton, New Zealand, do hereby declare this invention to be described in the following statement:

IMPROVEMENTS TO TRAILER BRAKING SYSTEMS

TECHNICAL FIELD

This invention relates to improvements to trailer braking systems.

More specifically, the present invention relates to improvements to trailer braking systems that co-relate the braking of the towing vehicle to the braking on the trailer.

BACKGROUND ART

For safety reasons, it is advantageous to have a braking system on a towed apparatus such as a trailer.

Mechanical and electrical towed vehicle braking systems are known.

One such device utilises the force of the towed apparatus against the towing vehicle when the towing vehicle decelerates. This force is converted mechanically to a braking force on the towing vehicle.

With this arrangement, there is a poor coloration between the braking force applied to the towing vehicle as opposed to the braking force applied to the towed apparatus.

Another system, described in United States patent 5382085, to Zbinden consists of an electrohydrolic or electropneumatic braking control device for the axles of trailers having mechanical brakes. A force proportional to the displacement of the brake pedal on the towing vehicle is said to be applied to the trailer brakes.

However, the braking force sensed on the towing vehicle is dependant on the distance that the braking pedal moves. Therefore, the braking force readings sensed are potentially erroneous.

Variations from vehicle to vehicle in pedal-free play may mean the braking force sensed at the pedal may not correspond accurately to the braking force applied to the towing vehicle. Further, known trailer braking systems are deficient in terms of electrical monitoring of the braking system, controlling unwanted movement of the trailer, and accommodating various trailer sizes and weights.

Further, in some jurisdictions, traffic regulations require trailers over a specific weight to have satisfactory braking systems installed.

It is an object of the present invention to address the foregoing problems or at least to provide the public with a useful choice.

Further aspects and advantages of the present invention will become apparent from the ensuing description which is given by way of example only.

DISCLOSURE OF INVENTION

According to one aspect of the present invention there is provided a system for effecting a braking force on a towed vehicle, the system including:

at least one braking sensor located on a towing vehicle,

a control unit,

a braking actuator mechanism located on a towed apparatus, towed by the towing vehicle responsive to signals from the control unit,

the system characterised in that the control unit determines the braking force sensed by the braking sensor and signals the braking actuator mechanism to apply a braking force at the towed vehicle proportional to the force applied to the braking sensor, determined by the control unit.

The term vehicles should therefore not be seen to be limiting.

Reference to a towing vehicle may include any vehicle or plurality of vehicles, capable of towing another apparatus.

Reference to a towed vehicle may be made with reference to any applications that requires towing, whether it is capable of it's own powered motion or not, and includes a plurality of found vehicles.

Reference to the braking actuator mechanism on the towed vehicle may include electronic and mechanical mechanisms necessary to effect the braking force on the towed vehicle. For example, this may include further electronic, hydraulic, pneumatic equipment.

The braking actuator mechanism may include any one or all of a compressor, an accumulator housing, pneumatic valving, service brake piston assembly, and a park brake assembly.

The park brake assembly may either be in a mechanical or hydraulic form.

The braking sensor may be a device that senses the braking force applied to the braking mechanism of the towing vehicle.

In situations where the braking is effected by depressing a pedal on the towing vehicle, the braking force sensor may be located on the brake pedal pad.

Preferably, the braking sensor may sense the force load exerted directly on the braking pedal of the towing vehicle.

Reference to the control unit may be made with reference to the appropriate electronics and electronic control mechanisms to sense the braking force sensor, and to sense the braking force sensor, and to perform the calculations and conversions necessary to provide the appropriate signal to the braking actuator mechanism.

The control unit may be referred to hereafter as the Electronic Control Unit (ECU).

Preferably, the ECU may include circuitry for system checking to assess whether the braking system is ready for normal operation.

The control unit may incorporate one or more ECU's mounted in either the towed or towing vehicle. The control unit electronics may be configured to operate as follows.

The force applied by the actuator mechanism in response to the ECU signal may be a percentage of the braking force sensed by the brake sensor on the towing vehicle.

The ECU may the read the load and relay the information to a towed vehicle mounted ECU.

A trailer-mounted ECU (herein after referred to as the auxiliary ECU) may then operate the brake actuator mechanism.

Preferably the auxiliary ECU may then open a feed-valve to the cylinder and the actuator mechanism so that air pressure is introduced to the cylinder via a compressor to a pre-determined air pressure.

The pre-determined air pressure will be gauged as is necessary to provide the necessary percentage of braking force to the towed vehicle relative to the braking pressure applied to the brake pedal of the towing vehicle.

The ECU on the towing vehicle may preferably constantly poll the load on the brake pedal.

If the pressure on the brake pedal increase, the sequence aforementioned continues until equilibrium is achieved.

If the brake pedal pressure is released, the towing vehicle ECU relays the message to the auxiliary ECU to relieve any pressure in the brake cylinder through an exhaust valve.

This sequence may repeat every time a pressure is sensed on the brake pedal pressure pad.

The above operating configuration is given as an example only and should not be seen to be limiting in any way.

In other embodiments the towed vehicle actuator mechanism may be configured to be operated independently for short periods of time.

These periods of time may be in situations where the towed vehicle is oscillating or loses traction.

The present invention may be configured so that applying the towed vehicle brakes will settle an unstable or oscillating vehicle.

In some embodiments there may be provided an activation means in the towing vehicle which will apply the towed vehicle brakes for only a pre-determined time and amount of force.

The system may be configured so that any force applied to the brake pedal by the actuator switch will be temporarily overridden.

The present invention may be configured so that if the auxiliary ECU becomes disconnected to the towing vehicle ECU, power will be cut to all of the components in the towed vehicle.

This may be arranged in such a way as to apply the brakes on the towed vehicle to 100 per cent of the unit's capacity.

In other embodiments the present invention may include automatic sway detection to detect towed vehicle osolations. This automatic sway detection may automatically detect the swaying of the trailer above a certain frequency and apply the trailer brakes independently to that of the towing vehicle for a pre-determined time period and force.

The present invention may provide for automatic towed vehicle weighing.

This may weigh the towed vehicle relative to its static unloaded state and apply a correction factor to the ECU for the required braking force. If the towed vehicle is empty, the maximum braking force may be set to a percentage of that of the loaded trailer.

For example only, if fifty per cent braking is required (as determined by the pressure pad sensor and the ECU) and the trailer is empty, the force applied to the brakes will be fifty per cent multiplied by the percentage of the maximum mass of the trailer.

The present invention may also include a visual display providing information on the status of the system.

The present invention may also provide for anti-lock braking.

According to another aspect of the present invention there is provide a method of applying a braking force to a towed vehicle proportional to a braking force applied at the towing vehicle, which includes a braking force sensor located on the towing vehicle, a control unit, and a braking actuator mechanism on the towed apparatus responsive to signals from the control unit, characterised by the steps of:

(i) sensing the force applied to the brake sensor,

(ii) converting the force to a pre-determined braking force to be applied to the towed vehicle,

(iii) signalling the brake actuator mechanism to apply the pre-determined proportional braking force.

The above method may be executed using apparatus as previously herein defined.

The pre-determined braking force may be preferably a percentage of the braking applied at the towing vehicle, which is determined by the signal from the brake sensor, and calculated by the control unit.

The present invention has a number of potential advantages. The present invention translate a pressure applied directly to the pad of the brake pedal under the operator's foot to sense brake application pressure. Therefore, the present invention overcomes potential problems associated with differing vehicles free-play in brake pedal movement, which could potentially result in incorrect braking force calculation and application.

The extensive electrical monitoring and control of the system, means that if a failure occurs anywhere in the system, the driver of the towing vehicle will be alerted of the problem.

If the towed vehicle becomes un-coupled, the present invention is configured to apply braking force to the trailer, reducing the risk of damage or accident to other property or persons as a result of the un-coupled trailer.

BRIEF DESCRIPTION OF DRAWINGS

Further aspects of the present invention will become apparent from the following description which is given by way of example only and with reference to the accompanying drawings in which:

Figure 1 ;shows a squematic view of one embodiment of the present invention

BEST MODES FOR CARRYING OUT THE INVENTION

Figure 1 shows one possible configuration of the present invention.

The braking system (1) according to the present invention may consist of two main components. These are the controller assembly and the actuator mechanism.

The controller circuitry consists of four components:

i) The pressure pad sensor (2) mounted to the towed vehicle brake pedal,

ii) an on-dash display module (3),

iii) a towing vehicle-mounted ECU (4) (Electronic Control Unit),

iv) a towed vehicle-mounted ECU (5).

The actuator mechanism, located on the towed vehicle consists of several components including a compressor (6), an accumulator housing (8), pneumatic valving (7), service brake piston assembly, (not shown) and a park brake assembly (in either mechanical or hydraulic form) (not shown).

The towed and towing vehicle electronics may be connected by pin plugs (9).

The towing vehicle ECU (4) functions as the main control unit of the system.

The ECU may be configured to operate as follows.

When the system is initialised, the ECU may turn on the compressor. While the compressor is building up pressure, an on-dash display may show the pressure in the accumulator. Once the compressor has charged the accumulator to an appropriate pressure (for example 100 PSI), the ECU may receive a signal from one of two pressure transducers in the accumulator mechanism to turn off the compressor.

The on-dash display may indicate that all systems are normal and ready for braking application.

When the tow vehicle brakes are applied, the pressure pad sensor, which is located on the brake pedal pad, registers a load being applied to the brake pedal. This load is "read" by the tow vehicle ECU ("auxiliary ECU"), which then relays the information to the towed vehicle ECU, to open the fed valve to the cylinder. This is then translated to air pressure to be applied to the service brake assembly in the actuator mechanism.

Once the pre-determined air pressure (measured by the second pressure transducer) is reached, the auxiliary ECU closes the feed valve.

The pressure on the brake pedal is polled continuously. If the pressure on the brake pedal increases, the sequence continues until equilibrium is achieved. When the brake pedal pressure is released, the tow vehicle ECU relays the message to the towed auxiliary ECU to relieve any pressure in the service brake cylinder through opening an exhaust valve.

The above sequence may repeat every time pressure is sensed on the brake pedal pressure pad.

In some embodiments the trailer brakes (10) may also be operated independently for short periods of time.

For example, in the situation of trailer swaying, for example because of icy roads, applying the trailer brakes only will settle the vehicle.

A button may be provided on the dash display module, which will apply the trailer brakes for only a pre-determined time and amount of force.

If the button is pressed, any force applied to the brake pedal will be temporarily overridden with respect to the towed vehicle to a threshold level.

The present invention may also provide for self-monitoring and fault detection.

Preferably, the electronics may be configured so that if a fault is detected in the system, a warning light will illuminate on the dash display module and will sound an alarm if conditions dictate.

As an example, the parameters monitored by the warning system may be as follows:

- Compressor overtime (for example, nominally set to two minutes)
- Compressor over current (nominally set to twenty amps)
- Low air pressure (for example, light illuminating at approximately 70 PSI, with the buzzer sounding at 50 PSI, allowing enough air pressure for one emergency stop manoeuvre)
- Trailer plug uncoupling.

Of course these parameters are examples only, or different parameters may be monitored by the fault detection circuitry.

The electronics may be configured so that if any warnings appear, the driver of the tow vehicle must complete physical cancellation of the light or buzzer, by pressing the panic button.

This will cancel the fault warning signal but will not remedy the problem with the braking system.

The fault warning may be configured to continue, so long as it is not being fixed.

The system may be configured so that when the unit is unplugged from the tow vehicle and a dust cap or other device is replaced, an electronic cancellation unit is provided which indicates to the tow vehicle ECU that the trailer is uncoupled and to deactivate the system.

However, once the electronic cancellation unit, which may be on a dust cap, the system according to the present invention will become activated and will look for the trailer mounted ECU. If one is not found, the warning sequence will resume.

The present invention may also be configured so that when the trailer is unplugged, power is cut to the trailer-mounted ECU. This results in power being cut to all of the components mounted on the trailer.

In preferred embodiments, the valves on the service brake cylinder may be arranged in such a way that when the valves loose power, the feed valve opens and the exhaust valve closes.

The arrangement will be configured so that this will result in the service brake cylinder receiving all of the pressure inside the accumulator.

In the event that no warning lights illuminated when the brake cylinder receives all the pressure inside the accumulator, the brakes on the trailer will be applied to one hundred per cent of the unit's capacity.

The above configuration provides for situations where the trailer becomes disconnected from the towing vehicle. The brakes will be applied automatically to the trailer.

The system may be configured so that in order to release the brakes the air pressure inside the accumulator mechanism must be released. This may be achieved by pressing a pressure release valve at the back of the unit which will evacuate all of the air pressure in the system. In order to reapply the brakes without the use of power, a parking brake lever may be provided.

The lever may be configured so that when it is moved from its rest position to the on position, it will apply the brakes.

If the system is in the discharged state, the initialising sequence may occur again.

The system may also include automatic trailer sway detection. The sway detection may include a module that automatically detects the swaying of the trailer above a certain frequency and applies the trailer brakes independently to that of the tow vehicle for a certain pre-determined time and force.

The present invention may also include automatic trailer weighing whereby the trailer is weighed relative to a static unloaded state. A correction factor may be determined and applied by the ECU for determining the braking force.

Antilock (ABS) braking may also be a feature of the present invention.

Aspects of the present invention have been described by way of example only and it should be appreciated that modifications and additions may be made thereto without departing from the scope thereof.

ES PLASTICS LIMITED

by its Attorneys

JAMES & WELLS

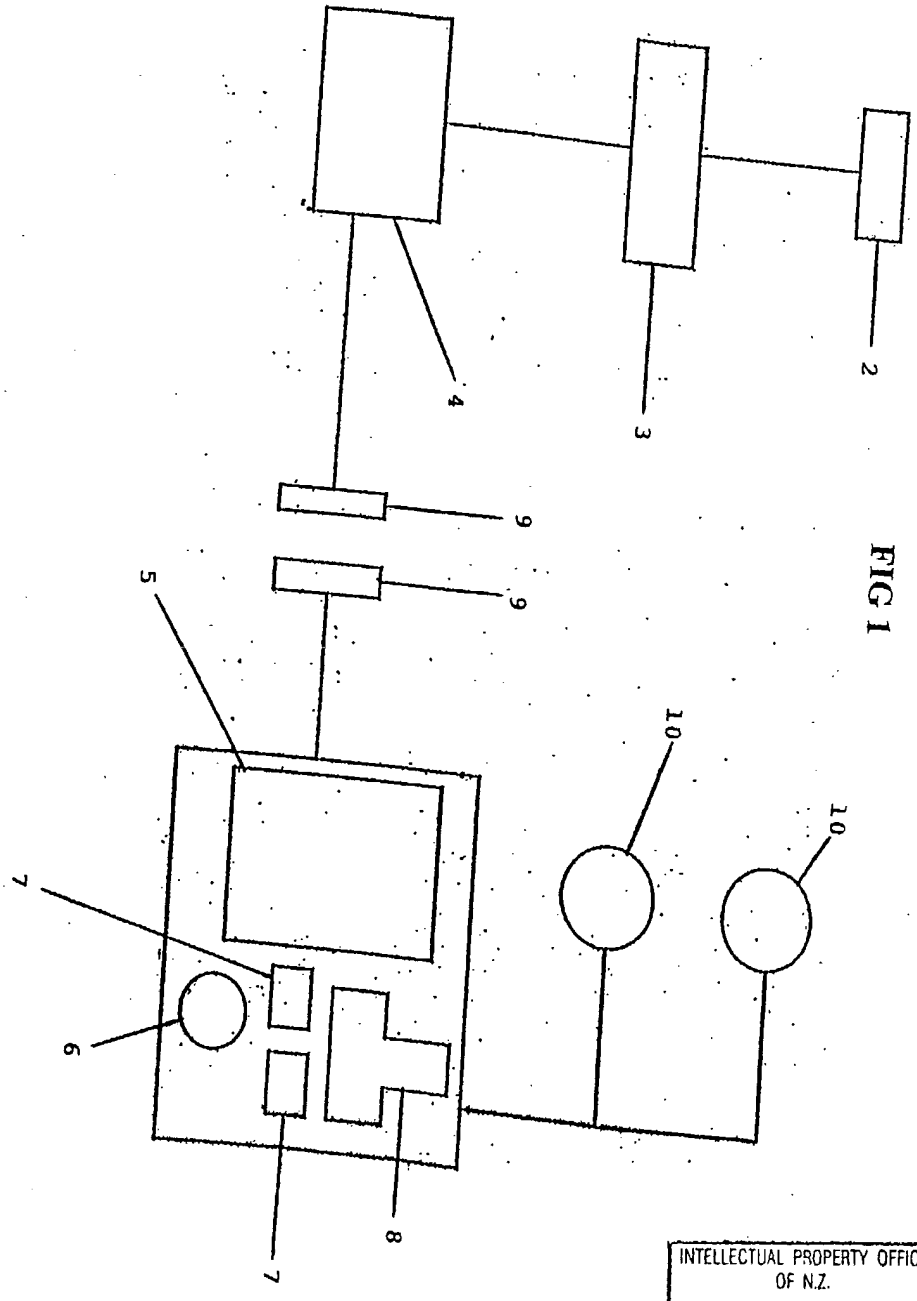

FIG 1